Surface States and Quantum-Well States of Lanthanide Metals: Electronic Structures, Lifetimes, and Correlation Effects

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We have studied surface states on trivalent lanthanide metals and quantum-well states in Yb(111) films by low-temperature scanning tunneling microscopy (STM) and spectroscopy (STS). The states we looked at are laterally highly localized and lead to sharp peaks in STS spectra close to the Fermi energy. From the linewidths of the states, we get detailed information on electron-phonon, electron-electron, and electron-magnon scattering. Interaction of the Lu(0001)-surface state with magnet impurity atoms (Gd, Ho) results in Kondo-like resonances directly at the Fermi energy.